

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY)

2. REPORT TYPE
Technical Papers

3. DATES COVERED (From - To)

4. TITLE AND SUBTITLE

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER
2303

5e. TASK NUMBER
0026

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory (AFMC)
AFRL/PRS
5 Pollux Drive
Edwards AFB CA 93524-7048

8. PERFORMING ORGANIZATION
REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory (AFMC)
AFRL/PRS
5 Pollux Drive
Edwards AFB CA 93524-7048

10. SPONSOR/MONITOR'S
ACRONYM(S)

11. SPONSOR/MONITOR'S
NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

20021212 113

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:

a. REPORT

Unclassified

b. ABSTRACT

Unclassified

c. THIS PAGE

Unclassified

17. LIMITATION
OF ABSTRACT

A

18. NUMBER
OF PAGES

19a. NAME OF RESPONSIBLE
PERSON

Leilani Richardson

19b. TELEPHONE NUMBER
(include area code)

(661) 275-5015

1 item enclosed

230310126

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

12 Apr 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-083**
Rene Gonzalez, Steven Svejda, Shawn Phillips, Gar Hoflund, "Surface Studies of Space Survivable
Hybrid Organic/Inorganic Polymers"

American Chemical Society Meeting
(Chicago, IL, 26 Aug 2001) (Deadline: 15 May 01)

(Statement A)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

Comments: _____

Signature _____ Date _____

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b) appropriateness of references, if applicable; and c.) format and completion of meeting clearance form if required

Comments: _____

Signature _____ Date _____

4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL Date
Technical Advisor
Space and Missile Propulsion Division

Surface Studies of Space Survivable Hybrid Organic/Inorganic Polymers

Rene I. Gonzalez, Steven A. Svejda and Shawn H. Phillips,
Air Force Research Laboratory, AFRL/PRSM
Edwards AFB, CA 93524-7680

Gar B. Hoflund
Department of Chemical Engineering
University of Florida
Gainesville, FL 32611-6005

ABSTRACT

The aggressive conditions present in low-Earth orbit (LEO) reduce the longevity of organic materials used in the construction of space vehicles, thereby restricting the number of available space-certified polymers. Many studies have been conducted in an effort to determine the degradation mechanism of polymeric materials primarily caused by surface reactions with atomic oxygen (AO), the predominant species in LEO. However, these studies were carried out after exposing these highly reactive surfaces to air prior to analysis, thus introducing artifacts not generated in the space environment. Recent testing of polymers containing the nanostructured Si-O frameworks known as POSS (polyhedral oligomeric silsesquioxanes) has shown these materials to have promising AO resistant properties. The polymers were exposed to AO produced by a hyperthermal oxygen atom source capable of producing a neutral, steady state flux of AO comparable to the actual LEO environment. In-situ XPS analysis reveals that POSS-polymers rapidly form a glassy, passivating SiO₂ layer preventing further degradation of the underlying polymer. This presentation will focus on the synthesis, AO testing and subsequent materials characterization of hybrid POSS polymers including POSS-PDMS, POSS-polyurethane, POSS-polyimide and POSS-polyolefin copolymers.

KEY WORDS: atomic oxygen, POSS, silsesquioxane, polymer, space, polyimide

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited